

## REMARKS

This paper is filed in response to the Office Action mailed on August 23, 2005. Currently, Claims 14-61 and 63-83 are pending in the application. Claims 66-71 are allowed. Claims 16, 17, 27, 28, 34, 35, 45, 46, 63, 79, and 80 are objected to. Claims 14, 15, 18-26, 29-33, 36-44, 47-61, 64-78, and 81-83 have been examined and stand rejected.

### The Rejection of Claims 14, 15, 19, 24, 31, 38, and 58 Under 35 U.S.C. §§ 102(b) and 103(a)

Claims 14, 15, 19, 24, 31, 38, and 58 are rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative under 35 U.S.C. § 103(a) as obvious over Chowdhury et al. (U.S. Patent No. 5,798,180). Applicants respectfully traverse the rejection.

Claims 14, 24, and 31 recite, in part, "one end of a molecule of the graft polymer is bound to a surface of the pore." Claims 15 and 19 depend from Claim 14. Claim 38 recites, in part, "... one end of the resulting polymer molecule is bound to a surface of the pore." Claim 58 recites, in part, "... a proton conductive, graft polymer ... is chemically bound to a surface of a pore."

The advantages of having a molecule of the graft polymer bound to a surface of the pore include: methanol crossover is reduced, or the filled polymer cannot be released from the pore of the substrate since one end of a molecule of the graft polymer is bound to a surface of the pore, therefore, high proton conductivity is exhibited because of the binding of the graft polymer to the surfaces of the pores.

The Examiner states,

Since Chowdhury et al. teaches that the sulphonated poly(2,6-dimethyl-1,4-phenylene oxide) solution was cast on the substrate membrane which has a porosity and is wettable then inherently the pores of the porous substrate would be filled with the graft polymer and one end of a molecule of the graft polymer is bound to the surface of the pore must also be obtained.

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Applicants understand that the Examiner is asserting that the feature "one end of a molecule of the graft polymer is bound to a surface of the pore" is inherent in the Chowdhury patent.

"The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." M.P.E.P. § 2112.IV, page 2100-57, rev. 3, August 2005 (citing *In re Rijckaert*, 9 F.3d 1531, 1534, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993)). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that the certain thing may result from a given set of circumstances is not sufficient.'" *Id.* (citing *In re Robertson*, 169 F.3d 743, 745, 49 U.S.P.Q.2d 1949, 1950-51 (Fed. Cir. 1999)).

Applicants believe that the Chowdhury patent does not inherently result in one end of the molecule being bound to the surface of a pore, as is assumed in the Office Action. The Chowdhury patent teaches a solution casting method of applying an aromatic polyether onto the membrane. Applicants submit that the solution casting method does not result in one end of the polymer molecule being bound to the surface of the pore.

The Chowdhury patent states, "[t]he ion-selective separators are prepared by solution casting a dilute solution of the aromatic polyether on the membrane substrate. For example, Celgard separators (Hoescht Celanese Corp) were coated by contacting the separator with a dilute solution of SPPO (1 wt% in methanol) and air drying for 24 hours." (Column 4, lines 55-60.) As can be appreciated from the foregoing passage, methanol is a good solvent for SPPO. Therefore, if methanol is contacted with the resulting ion-selective separator, and SPPO is leached out from the resulting ion-selective separator, then one end of a molecule of SPPO is not bound to the surface of the pore of the membrane substrate.

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In this regard, applicants respectfully request consideration of the attached Declaration of T. Yamaguchi (the "declarant"). In the declaration, the declarant states qualifications that establish him as being one of ordinary skill in the art. Declarant describes an experiment to test whether a sulphonated polyethersulfone (SPES polymer) binds to the surfaces of pores in a substrate. In the experiment, a porous polyimide substrate, a SPES polymer, and N-methylpyrrolidone were used, instead of the membrane substrate, SPPO, and methanol, which are described in the Chowdhury patent. A membrane was prepared by applying a solution of SPES polymer in N-methylpyrrolidone onto the porous polyimide substrate and then drying the membrane. Therefore, the method is similar to the solution casting method taught in the Chowdhury patent. The appearance of the membrane was noted and the weight was recorded. The "filling" ratio was stated to be 60% above the weight of the substrate alone and represents the amount of SPES polymer. The membrane was then immersed in hot water at 80°C for 24 hours. Water is stated to be a good solvent for SPES polymer. The change in appearance of the membrane after the hot water treatment was noted and the weight of the membrane was recorded. The "remaining" ratio was stated to be 5% of the weight of the SPES polymer initially present.

The declarant states that the experiment resulted in almost all of the SPES polymer being leached from the membrane (last paragraph, page 3 of Declaration). Applicants submit, therefore, that if one end of the SPES polymer was chemically bound to a surface of a pore, the SPES polymer could not have been leached out, and the "remaining" ratio would have been substantially higher.

By analogy, applicants submit that SPPO is leached out from the ion-selective separators disclosed in the Chowdhury patent when the ion-selective separators are immersed in a solvent, such as methanol, since membranes prepared from SPES polymer by the solution casting method

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do not result in one end of molecules being bound to the surfaces of pores, as is demonstrated in the Declaration.

Should the Examiner have any questions about the Declaration, applicants request advance notification to prepare for a telephone conference or, alternatively, an in-person conference with the Examiner and the declarant, should the declarant be available

In view of the Declaration and the discussion above, applicants respectfully submit that the burden to rebut the inherency rejection based on the Chowdhury patent has been complied with. Accordingly, the withdrawal of the rejection of Claims 14, 15, 19, 24, 31, 38, and 58 is respectfully requested.

The Rejection of Claims 14, 15, 18-26, 29-33, 36-44, 47-49, 53-61, 64, 65, 72-78, and 81-83 (Under 35 U.S.C. §§ 102(e) and 103(a))

Claims 14, 15, 18-26, 29-33, 36-44, 47-49, 53-61, 64, 65, 72-78, and 81-83 are rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Formato et al. (U.S. Patent No. 6,248,469). Applicants respectfully traverse the rejection.

As an initial matter, Claims 39-41, 59, and 72-83 have been canceled without prejudice or disclaimer, leaving Claims 14, 15, 18-26, 29-33, 36-38, 42-44, 47-49, 53-58, 60, 61, 64, and 65 for consideration. Claims 14, 24, and 31 recite, in part, "one end of a molecule of the graft polymer is bound to a surface of the pore." Claims 15 and 18-23 depend from Claim 14. Claims 25, 26, 29, and 30 depend from Claim 24. Claims 32, 33, 36, and 37 depend from Claim 31. Claim 38 recites, in part, "... one end of the resulting polymer molecule is bound to a surface of the pore." Claim 42 recites, in part, "wherein at least one graft polymer molecule is bound to a surface of a pore in the porous substrate at one end of the graft polymer molecule and the graft polymer fills the pore." Claims 43, 44, 47, and 48 depend from Claim 42. Claims 49, and 53-57 are discussed below. Claim 58 recites, in part, "a proton conductive, graft polymer is

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chemically bound to a surface of a pore." Claims 64 and 65 depend from Claim 58. Claim 60 recites, in part, "wherein at least one graft polymer molecule is bound to a surface of a pore in the porous substrate at one end of the graft polymer molecule and the graft polymer fills the pore." Claim 61 depends from Claim 60.

The Examiner states,

Since Formato et al. teaches that the porous substrate is interpenetrated with an ion-conducting material then inherently the pores of the porous substrate would be filled with the graft polymer and one end of a molecule of the graft polymer is bound to the surface of the pore must also be obtained.

In addition, the presently claimed property of the pores of the porous substrate would be filled with the graft polymer and one end of a molecule of the graft polymer is bound to the surface of the pore would have obviously have [sic] been present once the Formato [sic] et al. product is provided. *In re Best*, 195 USPQ 433 (CCPA 1977).

In accordance with the citations of the M.P.E.P. above, applicants respectfully submit that inherency is not established for the claims to have been rendered unpatentable.

Additionally, as discussed above, applicants submit that a sulphonated polyethersulfone does not bind to the surfaces of pores in a membrane when applied by the solution casting method.

The Formato patent also discloses membranes prepared by the solution casting method. For example, the Formato patent states, "[m]icroporous PBO . . . was added to a 5 wt% solution of the sulfonated Radel R<sup>®</sup> polymers in NMP. After twelve or more hours, the films were removed and placed in a 20 wt% solution of the same ion-conducting polymer (also in NMP). After twelve or more hours at room temperature (or at 75°C) the films were removed, stretched in tensioning rings, and dried of the solvent. Specifically, the sulfonated Radel R<sup>®</sup>/PBO films were dried in a low humidity chamber (<5% RH) for 1 to 2 days, vacuum dried in an oven heated from below 60°C to about 200°C." (Col. 42, lines 49-60).

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Therefore, the Formato patent discloses the membrane is prepared by the solution casting method and, thus, the sulfonated Radel R<sup>®</sup> polymers are leached out from the film when the film is immersed in a good solvent (NMP is a good solvent for the sulfonated Radel R<sup>®</sup> polymers from the description of "a 5 wt. % solution of the sulfonated Radel R<sup>®</sup> polymers in NMP").

Therefore, as discussed above, applicants respectfully submit that the "solution casting" method does not result in one end of the polymers being bound to the surfaces of the pores of a membrane.

Claim 49 recites, "applying a sol to a first electrode" and "forming a porous thin layer from the applied sol." The recited features can provide an assembly of the first electrode (13) and the electrolyte membrane (23), as shown in FIGURE 5 of the present application.

The Formato patent does not teach or suggest, at least, the above-mentioned steps, nor the resultant assembly. Applicants submit that the Formato patent merely discloses a method for preparing a film comprising a step of applying a solution of polymer to a substrate, to obtain an electrolyte membrane (see Example 9 of Formato patent). A step of applying a solution of polymer to a substrate to obtain an electrolyte membrane as taught by the Formato patent is different from the two steps of applying a sol to a first electrode, and then transforming the applied sol to a porous substrate.

*Prima facie* obviousness requires a suggestion or a motivation either in the references or in the knowledge generally available to modify a reference or to combine references, a reasonable expectation of success, and all the claim limitations must be taught or suggested in the prior art references.

Therefore, because the Formato patent does not teach or suggest, at least, the steps of Claim 49, applicants submit that Claims 49 and 53-57 are not obvious over the Formato patent.

Accordingly, the withdrawal of the rejection of Claims 14, 15, 18-26, 29-33, 36-38, 42-44, 47-49, 53-58, 60, 61, 64, and 65 is respectfully requested.

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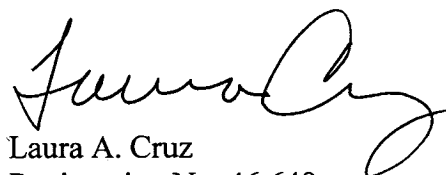
Allowable Subject Matter

Claims 66-71 are allowed. Claims 16, 17, 27, 28, 34, 35, 45, 46, 50-52, 63, 79, and 80 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Applicants note with appreciation the indication of allowable subject matter in these claims.

In view of the foregoing amendments and remarks, applicants submit that all pending claims are in condition for allowance. As indicated before, applicants respectfully request an interview with the Examiner before the next Office Action, should the next Office Action not be a Notice of Allowance. In the meantime, if the Examiner has any further questions or comments, the Examiner may contact the applicants' attorney at the number provided below.

Respectfully submitted,

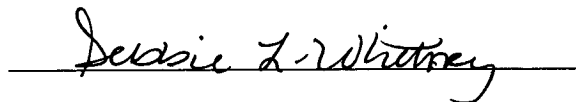
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Date: December 23, 2005



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